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ABSTRACT

Medical and dental clinical training involve learning of a sequential set of behaviors leading to a specified terminal behavior which must be performed according to certain criteria. Because of the multiplicity of behaviors and criteria involved in learning to perform the target behaviors as a coordinated whole, the traditional format of stating an objective in which a single behavior is related to a single criterion may not be appropriate. One new model for developing objectives that are compatible with the types of learning involved is the criterion and task analysis model. This consists of a set of performance criteria, a sequential list of actions, and a list of evaluation criteria. The list is generated through thoughtful self-analysis on the part of the instructor, who is an experienced clinician. When tested, student performance using the new model resulted in higher scores than were produced using the older one. (BN)

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SHOULD WE THROW OUT INSTRUCTIONAL OBJECTIVES IN HIGHER EDUCATION?

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SHOULD WE THROW OUT BEHAVIORAL OBJECTIVES IN HIGHER EDUCATION?

Introduction

Behavioral objectives are in trouble in some circles. They sounded great in theory. They worked fine at lower levels of education. But attempts to utilize them at higher levels of education have met with limited success. Particularly in the fields of medical and dental education there has been reluctance and resistance to application of the classic form of behavioral objectives.

The faculty in the basic science areas of professional training believe that "specific" objectives split or segment unified conceptual systems. Clinical instructors are frustrated as they attempt to describe complex ideas and procedures in terms of single concept objectives, without losing the total perspective.

Is there a place or a future for behavioral objectives in higher education, and, specifically, in professional education?

Identifying specific objectives of instruction and stating them in behavioral terms have been considered essential for effective teaching and efficient learning (Mager, 1962; Gronlund, 1970; Popham, 1973). The movement to require such statements of objectives for all courses in the curriculum has been with us for more than a decade. Medical and dental schools have been required to translate their curricula into behavioral objectives as part of the requirements for accreditation. Investment in terms of instructor and staff time and salaries expended in this effort has been phenomenal. Typically, a thick syllabus, containing hundreds of specific objectives for a course, is distributed among students once, and then forgotten. An often stated reason is that the students do not read them. The effort may contribute toward instructor development, but its contribution toward efficient

learning is not only questionable, but is largely nullified if it lacks user acceptability.

Recently, the instructional effectiveness of providing specific objectives, especially where conceptual learning is involved, has been more seriously question (Wittrock and Lumsdaine, 1977). In their concluding statement they also question their acceptance by the instructor who writes instructional objectives. They state:

> It is clear, however, that giving the learner behaviorally defined, specific or narrow objectives has not fulfilled its early promise. Objectives sometimes do not facilitate comprehensive learning, apparently because they are effective at selectively directing attention. They are tedious to construct, and they often constrain teachers to narrow their conceptually oriented instruction to the attainment of measurable but trivial ends. (Wittrock and Lumsdaine, 1977, p. 422).

Model Change Proposed

Should we simply conclude that behavioral objectives are not suitable for some types of learning and forget about them? Or, is further development and research in order? If the concept of instructional objectives is correct, and the instructional functions expected of them are legitimate, new and more basic approaches to their application should be conceived. If specificity and behavioral objectivity, required in stating Magerian objectives, have merit for providing measurability in evaluting instructional outcomes, they should not be readily discarded. What may be indicated are new models for developing objectives that are compatible with the types of learning involved and with learner characteristics, and that still satisfy

the basic criteria of acceptable behavioral objectives as proposed by Mager (Mager, 1962, p. 12).

In medical and dental education, terminal behaviors typically can be expressed only in very general terms such as "correctly diagnose" and "propose an acceptable treatment plan." Diagnostic behavior or planning behavior consists of multiple component behaviors which should take place in a sequential order and must satisfy multiple criteria. Insistence on specificity may result in numerous statements of objectives which are "tedious to construct" and for "trivial ends" as observed by Wittrock and Lumsdaine (1977).

An ideal model of instructional objectives should allow the instructor, who is an experienced clinician, to generate, on the basis of his clinical experience, objectives that satisfy all of the fundamental criteria for behavioral objectives as set by Mager (1962). The format of the instructional material thus developed should produce in the student meaningful and more efficient learning of the terminal behavior which involves multiple sequential activities and must meet multiple criteria. In other words, the instructional material based on the model should be meaningful for the instructor to write and for the student to use. It should possess high user acceptability. It should also provide "guidance in evaluation" and "direction for teaching and curriculum development" as suggested by Duchastel and Merrill (1973).

A New Model

The criterion and task analysis model of instructional objectives consists of a set of performance criteria, a sequential list of actions, and a list of evaluation criteria (Appendix A). They are produced by the process of self-analysis on the part of the instructor who is an experienced clinician. Typical questions he may ask himself as he evaluates a clinical task or

product (e.g., a gold crown) may be:

Where do I look first? (This identifies the locus of the first and probably the most critical criterion).

What do I look for there, and how do I decide whether it is acceptable or not acceptable clinically? (This identifies the descriptive characteristics of the criterion).

How can I describe each characteristic in specific and objective terms so that there would be no misunderstanding in communicating it to others? (This brings specificity and objectivity to the description of the criterion).

This process of self-analysis is continued until all criteria are identified, listed, and described.

In writing the procedure or a sequential list of actions, the instructor analyzes his own performance in meeting the criteria set for the clinical task or product. The evaluation criteria are simply summary and abbreviated statements of the performance criteria already identified, for the purpose of evaluation and feedback to the student.

The instructional material developed by the criterion and task analysis model meets all the criteria for behavioral objectives. It provides the student with the description of sequential activities he must engage in, as well as the instrumentation required and the conditions under which the activities take place. These descriptions, together with the criteria that define the goal, constitute the terminal behavior and the level of performance that is acceptable. When he learns to perform the correct activities in their correct sequence and meets all the criteria, he has reached the expected instructional outcome.

Instructional Efficiency

In 1976 and 1977, the criterion and task analysis model was applied to

eight major projects in a course in removable partial dentures which is taught in the junior year at the Loma Linda University School of Dentistry. A new laboratory manual was developed according to the model, replacing an existing manual with traditional instructional objectives.

Student performance for two successive classes (N = 72, 68) which used the new laboratory manual developed according to the criterion and task analysis model was compared with the performance of three previous classes of students (N = 66, 71, 73) who used a laboratory manual with traditional objectives. The laboratory projects, operational procedures, instrumentation, working conditions, instructional methods, and the number of laboratory hours remained unchanged. The evaluation criteria and procedures were kept identical for five years. An evaluation score ranging from 5 (excellent) to 1 (unacceptable) was assigned to each laboratory project by one of the authors (Wical) who was also the instructor for the course during these five years.

For seven out of the eight projects the means were significantly different when compared with analysis of variance ($P < .001$, .001, .01, .05, .05, .01, N.S., .001). In order to compare more specifically the scores for classes without the new instructional objectives with the scores for the classes with the new instructional objectives, the averages of the means for the first three years and for the last two years were obtained.

In each case the mean score for the last two years was higher than for the first three years. When compared with a t-test, the mean scores for six of the eight projects were significantly different ($P < .001$, .001, .05, N.S., .05, .01, N.S., .001).

In order to see if there were other pertinent factors that might have influenced the students' performance, the Dental Aptitude Test scores for all of the students in the five classes were analyzed. The DAT scores for the last two classes were not significantly different from the DAT scores

for the first three classes.

While the authors are of the conviction that the evaluation criteria were applied uniformly throughout the five-year period of this study, the possibility of bias from this source must be recognized. The dramatic differences observed for several of the projects together with the positive responses from the students and the subjective evaluation of the instructor lead us to believe that the criterion and task analysis model is quite effective for certain projects.

Traditional and New-Model Objectives Compared

Medical and dental clinical training typically involves learning of a sequential set of behaviors which leads to a terminal behavior or outcome (e.g., a correct diagnosis, a treatment plan, a partial removable denture, etc.,) that meets a set of criteria. Because of the multiplicity of the behaviors and the criteria involved in learning the terminal behavior as a coordinated whole, the traditional format of stating an objective, in which typically a single behavior is related to a single criterion, may not be appropriate. An additional problem is that following the traditional format of writing specific and behavioral objectives has resulted in a large number of short statements. This can result in segmental learning and confusion as Mackenzie observed when he stated: "Experience indicates that detailed objectives in the early stages of instruction overwhelm and confuse students." (Mackenzie, 1973, volume 1, p. 10).

This deficiency with the traditional format of behavioral objectives, when a complex terminal behavior is involved, was also discussed by Scandura. He observed that "operationally defined objectives have led some to fragmented curricula, curricula based on discreet bits of knowledge." (Scandura, 1971, p. 4). According to Scandura (1972) and Ehrenpreis and Scandura (1974), the behavioral objectives in its simplest form deals only

with observable behavior and says little about how that behavior is to be generated, and it provides no systematic way of dealing with interrelationships among the identified objectives.

More effective instruction in medical and dental training will result from lecture, demonstration, and textbook formats which aim at developing, for complex procedures, sets of criteria and required behaviors as a coordinated whole, instead of teaching them as so many segmented bits of information and action. One of the advantages of the new manual based on the criterion and task analysis model was that it enabled a student, before he began his laboratory project, to form a mental picture of an ideal product. He could proceed with a clear perception of the locus and appearance of each of the criteria which the product, or the procedure, should satisfy when it is completed. We propose that in the performance of a clinical procedure it is helpful to possess a "perceptual" advance organizer analogous to the "cognitive" advance organizer described by Ausubel (1968).

When the student possesses a clear understanding and perception of the criteria, the procedure becomes more meaningful and purposeful. With an adequately written procedure in the manual, the student often needs no additional explanation to proceed with the task and meet the criteria.

User Acceptability

In 1976 and 1977 when the new laboratory manual based on the criterion and task analysis model of objectives was implemented in the course, the students were asked to evaluate the manual and the course with a simple questionnaire (Appendix B). The results are presented in Table 1.

No data are available as to student acceptance of the previous edition of lab syllabus. Very high percentages of students were enthusiastic about the new syllabus as shown by their responses to Questions 1 and 2. The evaluation of the new syllabus as an instructional aid is revealed by such

comments as:

1. I think the syllabus is an excellent teaching aid. This class is the most organized we have had since histology from Dr. _____. Good class.

2. RPD lab went a lot better than complete dentures lab. I knew what I was doing.

3. If all the instructors in this school would cooperate in devising complete syllabi for all lecture and lab classes, the quality of learning would be enhanced and the material can be learned much more easily.

4. This class is so far ahead in facility than the course we had, it's unbelievable - great!

5. I'm very positive about this program compared with_____. We've really moved through a lot of material, but I've learned a lot.

Table 1

Student Evaluation of New-Model Lab Syllabus for Removable Partial Dentures

Question	Year	Yes	No	Undecided
1	1976*	96.6%	3.3%	-
	1977**	98.5%	1.5%	-
2	1976	93.3%	6.6%	-
	1977	89.3%	10.7%	-
3	1976	33.3%	56.6%	-
	1977	71.2%	24.3%	4.5%
4	1976	68.3%	30.0%	1.6%
	1977	88.1%	8.9%	3.0%
5	1976	85.0%	11.6%	3.3%
	1977	82.0%	18.0%	-

* N = 72
**N = 68

Significant shifts in student response occurred between 1976 and 1977 (though the same syllabus was used) in the areas of confidence in the uniformity of grading among different instructors (Question 5) and satisfaction with the grades given (Question 4). Prevalent and perenniel complaints by dental students taking laboratory courses have to do with the lack of uni-

formity among instructors as to opinions rendered in evaluation and grades issued for different reasons. Any improvement in this area will reduce a source of frustration for dental students.

In 1976 when the new syllabus was issued to the students, the instructors involved in the course were not fully acquainted with the contents. Some typical student responses were.

1. Same old problem. Some instructors grade harder than others and seems like it is not too fair.
2. On the whole I think that the syllabus was good and informative. As far as uniform grading I did not see its effect that much.

In 1977 when the instructors involved in the course were familiarized with the contents of the syllabus, especially with the criteria, student confidence in the uniformity in evaluation and satisfaction with grades improved dramatically.

When the instructional efficacy of specific and behavioral instructional objectives is being questioned, it may be well to proceed cautiously in evaluating the problem of objectives. The basic concept and essential elements that constitute instructional objectives need not to be changed. New models should be developed that can generate objectives that are more suitable for various types of learning.

APPENDIX A

PROJECT 6: MAXILLARY CL. II RPD DESIGN

The objectives of projects 6, 7, and 8 are: 1. To increase your familiarity with and skill in surveying and tripoding; 2. To reinforce your concepts of guide plane and occlusal rest configuration; 3. To gain skill and confidence in drawing design patterns; and, 4. To progressively introduce increasingly complex RPD design problems concurrent with lectures given on the corresponding design principles.

Instruments required for projects 6, 7 and 8:

- Surveyor and accessories
- Red and blue pencil
- Scalpel with sharp blade
- Discoid carver
- Fiberglass eraser

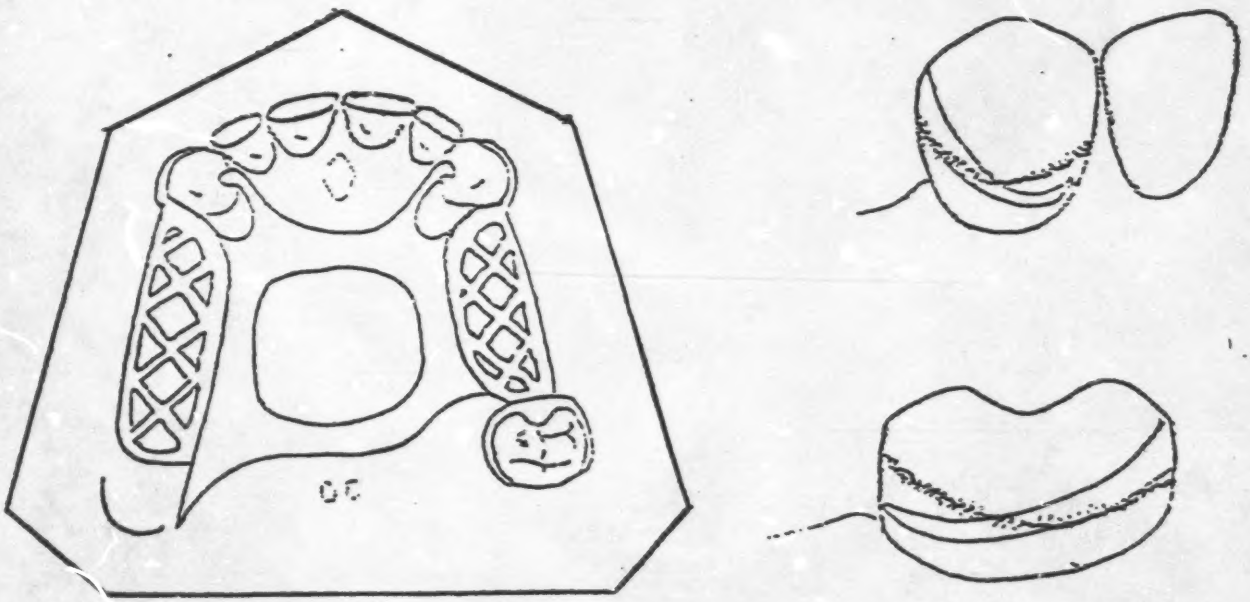
A new cast will be issued for each of these projects.

1. Evaluate the cast according to the criteria given in Project 1. Trim off any casting irregularities. Keep the cast clean and neat throughout the entire exercise.

2. Survey the cast and mark the tripoding points for future reorientation.

3. Mark the survey lines on the abutment teeth.

4. Sketch the following design on the cast with red pencil:



Note the following design features:

a. Double (anterior-posterior) palatal bar.
b. Dimple rests on the mesial marginal ridges of the cuspids.
c. Minor connectors reaching from palatal connector to dimple rests.
d. Circumferential clasps on all abutment teeth.

Criteria to be met for design:

a. Anterior palatal bar must be distal to indisive papilla. Borders follow natural valleys between rugae, but should cross center of palate perpendicular to midline. Width should correspond to example drawing.
b. Posterior bar must be anterior to fovea. Borders cross center of palate perpendicular to midline. Width of bar is uniform and matches example drawing.
c. Lateral borders of palatal "cutout" are at same level. "Cutout" area should be as symmetrical as design will allow. All "corners" are broadly rounded; no sharp corners are acceptable in the design of a major connector.
d. The major connector and the acrylic finish line extends nearly to the right hamular notch. (This is an important feature that is often overlooked). The acrylic retention mesh, however, does not usually cover the entire tuberosity.
e. Left and right acrylic finish lines are located about 4 mm. medial to a line corresponding to the location of the lingual edges of the anticipated denture teeth. The finish lines are on the same level as nearly as possible, so that they will feel "even" or "balanced" to the patient's tongue. The anterior ends of the finish lines curve laterally and upward to become continuous with the medial edges of the proximal guide plates.
f. Buccal borders of the acrylic retention meshwork extend only slightly past the crest of the edentulous ridge.
g. Dimple rests are located on the marginal ridges of the cuspids at the same level that a cingulum rest would be placed. Note that they are <u>not</u> placed in the lingual fossa of the cuspid.
h. Buccal retentive clasps should follow the configuration illustrated. Tip ½ only of the clasp below the survey line. (Tooth contour may have to be modified to achieve a favorable survey line, although you should experiment with moderate tilting, first). Tips of the retentive clasps should be located in 0.020 in. undercuts.

5. Have the drawing checked by an instructor. Correct it if necessary.

6. When the design is approved, prepare guiding planes and rest seats. Refer to examples of prepared dimple rests at the instructors' desk if necessary. The rest seat must provide a positive stop perpendicular to the path of insertion.

7. Recontour tooth surfaces if necessary, and mark new survey lines.

8. Retrace the final design outline with a sharp red pencil. (Refer to Project 1 instructions for hints on making sharp lines).

9. Clean the cast and write your number on the bottom of the cast.

10. TURN IN the completed project for evaluation. The graded and scored project will be returned to you at a subsequent laboratory period.

INSTRUCTOR EVALUATION - DESIGN CASTS

Projects 5, 6, 7, and 8

Criteria Acceptably Met	Criteria Partially Met	Criteria Not Met	Student No._____
☐	☐	☐	Guide planes and rest seats
☐	☐	☐	Adherance to design pattern
☐	☐	☐	Grasp of design details
☐	☐	☐	Symmetry and smoothness of design
☐	☐	☐	Clarity and neatness of drawing
☐	☐	☐	Tripod and survey marks
☐	☐	☐	Cleanliness of cast
☐		☐	Turned in on schedule

(Score of 2 or less requires remake.)

SCORE_____

APPENDIX B

EVALUATION OF RPD LAB SYLLABUS

Please check one of the boxes:	Yes	No
1. Was what you were expected to accomplish made clear by the criteria provided in the syllabus?	☐	☐
2. Were the techniques required to produce the desired product made clear by the procedures sections provided in the syllabus?	☐	☐
3. Do you feel that the criteria provided resulted in uniform grading of projects?	☐	☐
4. Do you feel that the criteria provided reduced dissatisfaction with grading, compared to other lab courses where criteria were not available?	☐	☐
5. Do you feel that the instructions and criteria reduced wasted time in the laboratory?	☐	☐

Comments:

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